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Mortality and Revascularization Following Admission for Acute Myocardial Infarction: Implication for Rural Veterans

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Abstract

Introduction: Annually, over 3,000 rural veterans are admitted to Veterans Health Administration (VA) hospitals for acute myocardial infarction (AMI), yet no studies of AMI have utilized the VA rural definition.

Methods: This retrospective cohort study identified 15,870 patients admitted for AMI to all VA hospitals. Rural residence was identified by either Rural-Urban Commuting Area (RUCA) codes or the VA Urban/Rural/Highly Rural (URH) system. Endpoints of mortality and coronary revascularization were adjusted using administrative laboratory and clinical variables.

Results: URH codes identified 184 (1%) veterans as *highly rural,* 6,046 (39%) as *rural,* and 9,378 (60%) as *urban*; RUCA codes identified 1,350 (9%) veterans from an *isolated town,* 3,505 (22%) from a *small or large town,* and 10,345 (65%) from *urban* areas. Adjusted mortality analyses demonstrated similar risk of mortality for rural veterans using either URH or RUCA systems. Hazards of revascularization using the URH classification demonstrated no difference for *rural* (HR, 0.96; 95% CI, 0.94-1.00) and *highly rural* veterans (HR, 1.13; 0.96-1.31) relative to urban veterans. In contrast, rural (relative to urban) veterans designated by the RUCA system had lower rates of revascularization; this was true for veterans from *small or large towns* (HR, 0.89; 0.83-0.95) as well as veterans from *isolated towns* (HR, 0.86; 0.78-0.93).

Conclusion: Rural veterans admitted for AMI care have a similar risk of 30-day mortality but the adjusted hazard for receipt of revascularization for rural veterans was dependent upon the rural classification system utilized. These findings suggest potentially lower rates of revascularization for rural veterans.

Key words access to care, geography, hospitals, rural, veterans.

The Veterans Health Administration (VA) is the nation's largest provider of comprehensive health care, serving 5.5 million veterans in 2007. Among VA hospitals, veterans with acute myocardial infarction (AMI) represent roughly 15,000 admissions annually and AMI quality of care has been extensively evaluated in the VA.[1-5] Furthermore, because more than one-third of veterans reside in rural areas, which may limit access to care, VA has significantly increased funding to evaluate disparities among rural veterans[6] and is actively designing and evaluating innovative ways to improve access and quality of care such as mobile clinics,[7] expanding telehealth,[8] and operating more than 700 community-based outpatient clinics.[9]

While these innovations are VA-specific, urban-rural disparities for access and quality have been demonstrated beyond VA populations. Among Medicare patients, rural hospitals are less likely to provide guideline-recommended AMI treatments compared to urban hospitals.[10] Similarly, despite innovations to improve access, rural VA patients report poorer health-related quality of life compared to urban patients[11,12] and use fewer health care services.[13,14]

Additional challenges exist when examining rural-urban differences. First, many studies have relied on hospital-level analyses that limit interpretation of results at a patient level.[15] Second, multiple definitions of rurality exist in the literature, which may confound interpretation of results[16] including a new rurality definition developed by the VA Planning Systems Support Group (PSSG).[16,17] To date, no studies have demonstrated the research applicability of this relatively new rural classification system.

Thus, we completed this study to accomplish the following objectives: (1) to identify whether 2 different rural classification systems identify differential rates of veterans admitted for AMI; (2) to examine if rural-urban disparities exist for risk-adjusted AMI outcomes (measured by mortality and receipt of coronary revascularization); (3) to determine whether hospital transfer rates differ for patients admitted with AMI; and (4) if rural-urban disparities are found, examine to what degree they are dependent upon the rural classification system utilized. This additional set of analyses is particularly important given the lack of a consensus definition of rurality among current health services research in this area.

Methods

Data Sources

Data were derived from 5 VA sources: (1) Patient Treatment Files (PTF); (2) Decision Support System laboratory files; (3) Enrollment Files; (4) Vital Status Files; and (5) PSSG files. The PTF contain data on all hospitalizations to VA hospitals nationally. Data elements include demographics; socioeconomic status; residential ZIP code; presence of disabilities related to military service; primary and secondary diagnoses and procedures as defined by the International Classification of Diseases, 9th Clinical Modification (ICD-9-CM) codes; admission sources (eg, transfer from another hospital, emergency room); admission and discharge times and dates; and discharge destination. Decision Support System laboratory files contain the results of selected laboratory tests performed on an inpatient or outpatient basis. Vital Status Files identify dates of death, which have similar validity as the National Death Index.[18,19]

Patient Population

The study sample was derived from all veterans admitted to VA acute care hospitals from 2006 to 2007. PTF data were used to identify 21,515 consecutive patients with the principal diagnosis of AMI (ICD-9-CM 410.xx). Next, 5,645 veterans with admissions for AMI in the 12 months prior to admission were excluded; thus, only patients with a relatively new AMI were included. This step was necessary to avoid including veterans coded with an AMI that was related to a previous diagnosis of AMI. Separate indicator variables were included for those patients transferred in from other facilities (n = 1,028) and for those patients admitted to VA hospitals with revascularization facilities (n = 15,478). The final study sample examined included 15,870 patients.

Study Variables

Main Outcome Variables

The 2 main study outcomes of interest were: (1) receipt of coronary revascularization within 30 days of index admission and (2) 30-day mortality.[20,21] We used ICD-9-CM procedure codes from the index hospitalization and from subsequent encounters within 30 days following the date of admission to identify the receipt of revascularization by either percutaneous coronary intervention (PCI; 00.66, 36.01-36.07) or coronary artery bypass graft surgery (CABG; 36.10-36.19). Secondary outcomes of interest were rates of transfer for AMI care and admissions to VA facilities without revascularization resources.

Main Independent Variables

The independent variable of interest was urban-rural residence using 2 alternative definitions: the widely used Rural-Urban Commuting Area (RUCA) code classification and a more recently adopted VA Urban/Rural/Highly Rural (URH) classification. RUCA codes were adopted as a census tract-based classification scheme that utilizes the standard US Census Bureau Urbanized Area and Urban Cluster definitions combined with work commuting information to characterize census tracts regarding their rural and urban status and relationships. Our study utilized a ZIP code-level approximation to census tract RUCA codes.[22] The RUCA algorithm creates 30 mutually exclusive categories representing population density and affinity to nearby urban centers. We collapsed the 30 codes into 4 previously defined categories: *urban areas, large rural towns, small rural towns,* and *isolated small towns.* Next, we collapsed the *"large town"* and *"small town"* categories into *"large or small town"* to represent 3 categories to facilitate ease of comparison with the 3-category VA URH classification. This grouping was selected based on preliminary analyses indicating the greatest level of concordance among the 3 URH rural categories.

The VA URH classification was identified from the PSSG files and is based on US Census Bureau delineations of *urban*, *rural*, and *highly rural* areas. Urban areas include urbanized census tracts within urban centers and the adjacent densely settled territory that together have a minimum of 50,000 persons and generally have a population density of at least 1,000 persons per square mile. *Highly rural* areas include territories with a population density of fewer than 7 persons per square mile; *rural* areas include all other territories.[23] Rural variables were missing in 262 (<1%) patients for URH codes and in 670 (4%) patients for RUCA codes.

Other Risk-Adjustment Variables

Other patient characteristics considered as variables in our risk-adjustment models included age, race (ie, white, black, other, or missing), gender, marital status, VA eligibility criterion (ie, presence of a service-connected disability or indigent), co-morbid medical conditions, location of AMI,[24] mechanical ventilation on day of admission, and results of 9 selected laboratory tests (ie, serum creatinine, blood urea nitrogen, albumin, total bilirubin, glucose, sodium, white blood cell count, hemoglobin, and troponin subtypes I and T). A separate indicator variable was created for patients transferred from another facility (n = 1,028) as these patients can serve as an important source of bias in AMI outcome models. All laboratory tests were captured within a 48-hour window surrounding the admission time. The risk-adjustment methodology utilized for AMI mortality has been previously described.[21]

Finally, as the absence of revascularization resources may have an independent effect on the receipt of revascularization, we included a variable in our models indicating if the admitting VA hospital had revascularization resources. We categorized the admitting VA hospital as a revascularization hospital if that hospital had recorded at least 5 ICD-9-CM codes for either percutaneous coronary intervention or coronary artery bypass graft in the year prior to the index admission. Thus, 73 VA hospitals (57%) had revascularization resources.

Analysis

The analysis consisted of several steps. First, we identified urban-rural distributions using either the RUCA or VA URH classification. Second, patient demographic and clinical characteristics associated ($P < .05$) with mortality and receipt of revascularization within 30 days were identified and compared according to urban-rural classification methods utilized. Third, bivariate relationships were assessed between each urban-rural classification and outcomes (ie, 30-day mortality and revascularization) using the appropriate statistical method depending upon the variable distribution (eg, Wilcoxon rank sum, χ^2, or t test). Fourth, differences in laboratory severity of illness scores and transfer rates were compared using both RUCA and VA URH classification.

Final models were built using the significant predictors identified in step 3 above. Each of these bivariate predictors of mortality or revascularization was then entered into stepwise multivariable regression analyses to identify independent ($P < .01$) predictors of mortality and revascularization. Variables included in the risk-adjustment models for 30-day mortality and their associated odds ratios are available from the authors upon request.

We used logistic regression analyses to model mortality and proportional hazards regression to model receipt of coronary revascularization, censoring patients who died prior to a procedure or who did not have a revascularization procedure within 30 days. In multivariable analyses, laboratory severity scores and troponin values were categorized into discrete ranges that maximized associations with mortality and were analyzed as separate (n-1) indicator variables; missing values were analyzed as separate indicator variables.

Next, variables from the multivariable risk-adjustment models were entered in separate generalized estimating equations or proportional hazards models that also included an indicator variable for the 3 classifications of urban-rural residence. Generalized estimating equation models used an exchangeable working correlation matrix to account for the clustering of patients within hospitals; proportional hazards models were estimated by conditioning on the admitting hospital. All models used a robust sandwich covariance matrix estimator to further account for clustering within hospitals. Proportional hazards assumptions were satisfied in the final models.

The authors had full access to and take full responsibility for the integrity of the data. All analyses were conducted using SAS® statistical software version 9.1 (SAS Institute, Inc., Cary, North Carolina). The study was approved by the Iowa City VA hospital Institutional Review Board and Research and Development Committee.

Results

Overall, study patients had a mean age (SD) of 67.8 (11.8) years, 98% were male, 73% were white, and 13% were black; race was missing in 5.3%. Noted minor differences were dependent on the rural classification system used regarding distributions of average age, black race, frequencies of co-morbid medical conditions, and average

Table 1 Demographic and Clinical Characteristics, Stratified by Urban-Rural Classification

	Average Age (SD)	Average Income(SD) ($ Thousands)	White n (%)	Black n (%)	Average Laboratory Score (SD)
RUCA					
Urban (n = 10,345)	67.6 (12.1)	22.9 (45.4)	7,288 (70.4)	1,818 (17.6)	5.6 (4.2)
Large or small town (n = 3,505)	67.6 (11.3)	21.1 (30.4)	3,033 (86.5)	222 (6.3)	5.7 (4.9)
Isolated town (n = 1,350)	68.4 (11.0)	23.2 (41.3)	1,187 (87.9)	69 (5.1)	5.7 (4.8)
VA URH					
Urban (n = 9,378)	68.0 (12.1)	22.0 (44.0)	6,084 (64.8)	1,732 (18.5)	5.7 (4.2)
Rural (n = 6,046)	67.8 (11.3)	22.3 (36.3)	5,250 (86.8)	363 (6.0)	5.7 (4.6)
Highly rural (n = 184)	68.7 (11.2)	24.8 (41.0)	148 (80.4)	1 (0.5)	4.9 (3.7)

laboratory score (Tables 1 and 2). Rates of identification of rural residence differed depending on the classification method used to define rural veterans (Figure 1). Furthermore, we identified 13% (n = 2,065) of veterans with anterolateral infarcts, 19% (n = 3,072) with inferoposterior infarcts, 27% (n = 4,421) with infarcts classified as "other site," and 60% (n = 9,558) with subendocardial infarcts.

Applying VA URH codes, the unadjusted 30-day AMI mortality rates were similar for *rural* versus *urban* veterans (8.1% [n = 488] vs 8.8% [n = 827]; $P = .15$) and *highly rural* versus *urban* veterans (6.0% [n = 11] vs 8.8% [n = 827]; $P = .19$). Applying the RUCA codes demonstrated a similar rate of unadjusted mortality for *large or small towns* versus *urban* veterans (8.6% [n = 303] vs 8.2% [n = 847]; $P = .76$) and *isolated towns* versus *urban* veterans (7.7% [n = 104] vs 8.2% [n = 847]; $P = .33$).

In logistic regression analysis, 30-day mortality was also similar across rural and urban classifications using the RUCA and VA URH methods. Using RUCA codes, veterans from *small or large towns* (OR, 1.06; 95% CI, 0.93-1.19) and *isolated towns* (OR, 0.92; 0.76-1.14) had similar odds of death relative to urban veterans. Similarly, using VA URH codes, *rural* (OR, 1.00; 0.90-1.12) and *highly rural* veterans (OR, 0.84; 0.53-1.31) had similar odds of death relative to *urban* veterans.

In contrast, receipt of revascularization within 30 days did demonstrate different hazard risks for rural veterans relative to urban veterans that were dependent upon the urban-rural classification methodology used. Using RUCA codes, we found that veterans from *large or small towns* (OR, 0.89; 95% CI, 0.83-0.95) and *isolated towns* (OR, 0.86; 0.78-0.93) had lower hazards for receipt of 30-day revascularization compared to *urban* veterans. Alternatively, using the VA URH classification, no difference was found for *rural* (OR, 0.96; 0.94-1.00) or *highly rural* veterans (OR, 1.13; 0.96-1.31) compared to *urban* veterans for receipt of 30-day revascularization (Table 3).

The final set of analyses examined the likelihood of being transferred or being admitted to a VA hospital with revascularization capabilities for rural versus urban veterans. Using the VA URH classification, we found that *rural* veterans were roughly 2 times more likely to be transferred relative to *urban* veterans (8.9% vs 4.7%;

Table 2 Rates of High Prevalence Medical Co-morbidities, Stratified by Urban-Rural Classification

	Diabetes n (%)	Hypertension n (%)	COPD n (%)	Heart Failure n (%)
RUCA				
Urban	3,879 (37.5)	7,202 (74.2)	2,135 (20.6)	2,664 (25.7)
Large or small town	1,375 (39.2)	2,371 (69.6)	815 (23.3)	879 (25.1)
Isolated Town	553 (40.1)	907 (67.2)	320 (23.7)	344 (25.5)
VA URH				
Urban	3,609 (38.5)	6,606 (70.4)	1,887 (20.1)	2,533 (27.0)
Rural	2,369 (39.2)	4,113 (68.0)	1,432 (23.7)	1,521 (25.2)
Highly rural	72 (39.1)	112 (60.9)	37 (20.1)	43 (23.4)

Figure 1 Rates of Identification of Urban-Rural Classification for Veterans Admitted for AMI by VA Urban/Rural/Highly Rural (URH) Classification and RUCA Classification

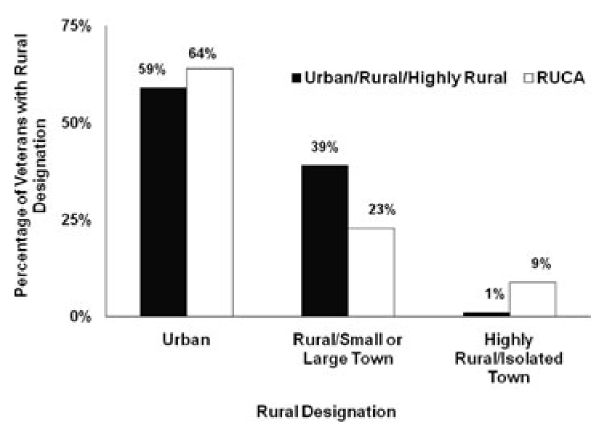

Table 3 Unadjusted and Adjusted Rates of Receipt of 30-Day Revascularization, Stratified by Urban-Rural Classification

	Receipt of Revascularization (%)	Hazards for Receipt of Revascularization (Adjusted)(95% CI)
RUCA		
Urban	3,422 (33.1)	Reference
Large or small town	1,088 (31.0)	0.89 (0.83-0.95)
Isolated town	404 (29.9)	0.86 (0.78-0.93)
VA URH		
Urban	2,953 (31.5)	Reference
Rural	1,948 (32.2)	0.96 (0.94-1.00)
Highly rural	58 (31.5)	1.13 (0.96-1.31)

$P < .001$), and those classified as *highly rural* were roughly 3 times more likely to be transferred (15% vs 4.7%; $P < .001$). The proportion of veterans transferred was somewhat different using RUCA codes. Veterans from *large and small towns* relative to *urban* veterans had a higher transfer rate (10.7% vs 4.9%; $P < .001$) as did veterans from *isolated small towns* relative to *urban* veterans (9.6% vs 4.9%; $P < .001$). Additional analyses using URH and RUCA codes found that rural veterans were more likely to be admitted to VAMC hospitals without revascularization facilities; however, the proportions of rural veterans admitted to such facilities varied somewhat based on the classification system utilized (Table 4).

Discussion

The current study compares associations between urban-rural residence and AMI outcomes using 2 alternative classification systems for identifying rural veterans (eg, RUCA and VA URH) and highlights the following findings. First, proportions of veterans admitted for AMI classified as having rural residence differed somewhat depending upon the classification system utilized. Second, there were minor differences in patient characteristics (ie, demographic and medical co-morbidities) that were dependent upon the classification system utilized. Third, there were no observed differences in risk-adjusted 30-day mortality regardless of the urban-rural classification system used. Fourth, rural veterans were less likely to receive revascularization but estimations of this risk were found to be dependent on urban-rural classification systems. Finally, rural veterans, regardless of rural classification, were observed to be transferred more often and were more likely to be admitted to VA hospitals without revascularization facilities.

Table 4 Unadjusted Analyses of Proportions of Rural and Urban Veterans (Including Transfers) Admitted to VAMC With Revascularization Facilities by Urban-Rural Classification

	Revascularization Facilities Present	χ^2 (*P* value)
RUCA		
Urban	9,137 (83.1)	Reference
Large or small town	2,251 (69.8)	279 (<.001)
Isolated small town	757 (67.1)	176 (<.001)
VA URH		
Urban	7,910 (84.4)	Reference
Rural	4,428 (73.2)	283.4 (<.001)
Highly rural	111 (60.3)	77.0 (<.001)

It is important to consider relevant research in this area to interpret these findings. Currently, many definitions of "rural" exist in the literature, some of which define distance from urban settings, density of surrounding population, distribution of scarce resources, or cultural perspective differences.[25-28] Directly related to the ways of defining rural residence, many studies have demonstrated that rural patients may lack core services that urban patients routinely have access to, such as public transportation, telephone and Internet services, case management services, and/or other outreach services.[29,30] Some propose that this lack of available resources leads to more self-reliance and home-based remedies for rural patients. Furthermore, rural patients may distrust doctors and other social service providers, relying instead on community-based support mechanisms.[30]

While the varying aspects of these definitions have been studied, there is some consensus that any rural definition should include an estimate of residents within a community. Therefore, the VA URH classification incorporates a population density measure and defines urban as any US Census Bureau-defined urbanized area, rural as any area not defined as urban, and highly rural as a rural territory with a population density of fewer than 7 civilians per square mile. Additionally, the RUCA coding scheme similarly uses population data (eg, US Census tracts) and these methods have been well described.[30-33] Therefore, we performed this study for the following reasons: (1) multiple rural classification systems have been applied in studies examining AMI outcomes; (2) studies have largely focused on hospital location as the unit of analysis; (3) there is a distinct lack of consensus on applying a rural definition in AMI outcomes health services research; and (4) the VA has recently adopted this PSSG URH methodology and, as yet, it remains largely untested.

First, we found that estimates of the risk for receipt of coronary revascularization within 30 days were highly dependent on the rural classification system utilized. Applying the RUCA classification resulted in estimations of lower rates of 30-day revascularization, a finding which is consistent with a previous report that also applied the RUCA classification system. For example, work by Baldwin et al[33] examined a Medicare population using Cardiovascular Care Project data and noted that patients admitted to rural hospitals were less likely to receive aspirin, intravenous nitroglycerin, heparin, and either thrombolytics or percutaneous transluminal coronary angioplasty. Furthermore, the authors reported that Medicare patients in rural hospitals had higher adjusted 30-day post-AMI death rates relative to patients admitted to urban hospitals.

Our inconsistent findings between the estimates of 30-day revascularization risk between the rural classification systems likely reflect the somewhat different identification strategies employed by each of the systems. For example, the specific rural categories for RUCA are parsed primarily on the basis of census data, which is further augmented by estimates of work-related traffic flow patterns between designated rural and urban centers. This differs in comparison to the 3-category designation of the VA URH system, which derives the designation of *highly rural* based on population density being fewer than 7 civilians per square mile.

Our mortality findings are inconsistent with those of Baldwin et al[33] and the more recent Ross et al[31] studies, as we did not find a mortality risk for rural relative to urban veterans regardless of classification system applied. This inconsistency may be due to the different analysis strategies employed by our study (ie, patient-level vs hospital-level analyses). These differences could also be related to differences in the population of our VA-based study relative to non-VA populations.[34] Alternatively, the findings may reflect organizational and infrastructure elements within the VA relative to the private sector where established referral systems and hospital choice may have a larger influence.[4] Less likely, as evidenced in other studies examining health care utilization, distance may influence where patients seek initial care, largely being influenced by the acuity of the event, or the initial care site may be associated with patient factors known to influence hospital-related mortality (eg, age, illness severity). This may be particularly salient in comparing our study to that of Ross et al, as our study found rural patients to be older and to have similar or higher rates of co-morbidities relative to that study's findings of patients admitted to rural hospitals being younger and with less co-morbid conditions.[31] Finally, among veterans, distance may play a larger role in the utilization patterns for cardiac care and other diseases.[35-37]

Second, our findings of similar or higher rates of medical co-morbidities (except hypertension) for rural veterans relative to urban veterans are similar to findings by Weeks et al[12] (Table 2). Both rural classifications had roughly the same identified distributions across all the identified medical co-morbidities. In separate analyses, we found that subtle clinical differences in the observed 30-day mortality were somewhat dependent on the rural classification system used. For example, using VA URH codes, we observed that mortality decreased as veterans were classified as rural. In contrast, when employing RUCA codes, we noted similar rates of observed mortality for those veterans living in *large or small towns* and only slightly lower mortality for those living in *isolated towns.* While not achieving statistical significance, adjusted models applying the RUCA codes identified *large or small town* veterans with a 6% increase in mortality, which is in agreement with Kindig[38] who found that rurality was a factor strongly associated with higher observed age-adjusted rates of death.

Third, we found that the proportions of rural veterans transferred for AMI care as determined using the VA URH and RUCA classifications differed slightly. Of the *highly rural* veterans identified using URH coding, 15% were transferred compared to only 10% of *isolated small town* veterans being transferred. This finding suggests that rural patients may be more likely to be transferred for specialty care. Additionally, in order for rural veterans that required more specialized care to tolerate a transfer, they were more likely to have lower illness severity. Consistent with prior literature,[39] subsequent analyses (not shown) indicated lower predicted mortality ($P < .05$) and lower observed mortality ($P = .05$) for transferred veterans. Finally, the observed rates of rural veterans receiving care at a VA hospital without revascularization facilities varied somewhat between the 2 systems of rural classification (Table 4).

The following limitations require consideration when interpreting this study. First, the study sample consists of an older, male veteran population and therefore may not be generalizable. Second, the definition of *highly rural* using the VA URH classification only identified 1.2% (n = 184) of the total study sample, thus limiting statistical power. It is possible that differences among this most rural category could represent a false negative finding due to a type II error. However, we feel that this study is strengthened by comparing multiple methods of defining rural, which increased the cell sizes >25 for all comparisons using the RUCA classifications. Third, our study is derived from administrative data of which the validity of ICD-9-CM codes may vary across individual diagnosis. Nevertheless, much work continues to be done examining AMI outcomes of veterans using these administrative database files. Moreover, our risk-adjustment models were further enhanced by the inclusion of specific cardiac markers for AMI injury and other general laboratory data.

Finally, this study was not able to capture important elements in the AMI care process that are pivotal for patients being admitted to hospitals that are equal distance. Studies exploring dual use of VA and non-VA care have demonstrated that several variables affect veterans' choice of hospital source of care. For example, more education, white race, available alternate insurance, higher income, and patient satisfaction affect particularly those rural veterans with an emergent medical need.[13] While our models did include an indicator variable for the nearness of a non-VA hospital and only examined regular users of VA, we were not able to examine outcomes of non-VA or dual users. This is an important consideration given that prior literature indicates that rural veterans may have different restrictions to federally funded health care relative to urban veterans.[13]

Despite these limitations, we feel this study lends insight into AMI care for rural veterans within the VA. First, despite the observation that rural veterans are more likely to be admitted to non-revascularization-capable VA hospitals and are more likely to be transferred, there were no differences in adjusted mortality between rural and urban veterans. Second, the VA URH classification system demonstrated slightly different associations with mortality and substantially different associations with receipt of revascularization compared to the RUCA classification system. The findings of this study suggest that the current VA URH variable identifies different sets of patients admitted for AMI than the more widely used RUCA codes. At this point we recommend that policy makers interpret with caution any single study that utilizes only 1 measure of rurality as the independent variable of interest.

In conclusion, this study represents an initial investigation using urban-rural residence as the unit of analysis for 2 AMI outcomes (mortality and revascularization), and it is the first to report on the VA URH classification versus RUCA classification. Also, this report represents novel analytic strategies recently highlighted to be relatively absent in the literature.[15] Finally, we report evidence that rural veterans appear to be at a similar risk of mortality to urban veterans following an admission for AMI. However, our study demonstrates that using a single rural classification system for estimating the effect of rurality on AMI outcomes among veterans may not be adequate and that further research is needed to confirm these results in other veteran populations.

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